

What is claimed is:

1. An illumination device comprising:

a substrate having a surface and a cavity in the surface;

at least one light emitting diode (LED) mounted within the cavity;

a phosphor monolayer comprising phosphor particles overlying the LED, the phosphor particles for converting the emitted light into white light, the phosphor monolayer adhered to the LED by a monolayer of adhesive material.
2. The illumination device of claim 1 further comprising overlying the phosphor monolayer, a thick layer of transparent material encapsulating the LED and optionally forming a lens.
3. The illumination device of claim 1 wherein the substrate comprises a heat sink and the LED is thermally coupled to the heat sink.
4. The illumination device of claim 1 wherein the LED is a blue or ultraviolet LED.
5. The illumination device of claim 1 wherein the phosphor monolayer is a monolayer of phosphor particles.
6. The illumination device of claim 1 wherein the phosphor comprises a YAG:Ce phosphor.

7. A method for making an illumination device comprising one or more white light emitting diodes (LEDs) comprising the steps of:

providing a workpiece comprising a substrate having a surface including one or more cavities that contain one or more LEDs connected to electrical leads;

forming a coating of tacky adhesive material overlying at least one of the LEDs;

exposing the coating of tacky material to particles comprising phosphor material to form a self-limiting coating of particles overlying the at least one LED; and

curing the tacky adhesive material.

8. The method of claim 7 further comprising the steps of applying an optical material in the cavity to encapsulate the coated LED and optionally to form a lens for the LED.

9. The method of claim 7 wherein the substrate comprises a heat sink and the LED is thermally coupled to the heat sink.

10. The method of claim 7 wherein at least one of the LEDs is a blue or UV LED.

11. The method of claim 7 wherein the coating of tacky adhesive material comprise a monolayer of tacky adhesive material.

12. The method of claim 7 wherein the coating of particles comprises a monolayer of

particles.

13. The method of claim 7 wherein the tacky adhesive material is cured by heating.

14. The method of claim 7 wherein the optical material applied to encapsulate the LED is applied by syringe injection or by injection molding.

15. The method of claim 7 further comprising the step of dicing the workpiece into a plurality of white LED devices.

16. The method of claim 7 further comprising the step of masking portions of the workpiece prior to coating with tacky adhesive.

17. Apparatus for coating phosphor particles on adhesive-coated LED workpieces comprising:

an enclosed particle coating chamber for receiving the workpieces,

a reservoir of phosphor particles to be coated, coupled to the chamber;

a source of pressurized gas coupled to the chamber through a Venturi Nozzle; and

a recycling chamber for receiving and recycling unused particles coupled to the chamber.